7.0 WATER SUPPLY

This chapter describes the quantity and quality of water required, the primary and back-up water supply sources, water quality, and waste water discharges for the Pico Power Project (PPP).

7.1 WATER SUPPLY AND USE

The City of Santa Clara will provide the industrial process water supply for the PPP through the South Bay Water Recycling Program. The City will supply reclaimed tertiary treated water to meet cooling and process makeup requirements. A "will-serve" letter from the City that describes the City's commitment of water supply to the project is included in Appendix 7-A.

The City of Santa Clara will provide potable water for emergency backup use. Due to water pipeline conveyance constraints in the City's potable water distribution system, the City has required that the PPP install a 1,000 to 1,500 gpm City-owned well on the project site. When and if the recycled water supply is interrupted, this well would supply the project with backup water. When not needed for the project, the well would function as one of the City's supply wells. The City has planned for additional wells to be added to its water supply system as part of its long-range master plan (see Section 8.15).

Interruption of recycled water supply is less likely at the PPP than at other locations that are further from the waste water treatment plant. In addition, the South Bay Water Recycling Program has demonstrated a high degree of reliability in delivering recycled water over the past several years (Appendix 7-C, letter from City of San Jose Environmental Services Department). It is therefore unlikely that recycled water would be interrupted in a normal year so that the project would require potable water for process use.

Water required for domestic uses and fire fighting will also be provided by the City of Santa Clara. A new connection would be made to the existing 12-inch potable water line that runs in the former Pico Way (on the project site). The City of Santa Clara's water supply comes from City wells and the Hetch Hetchy aqueduct.

Operation of the PPP will require an average of 0.94 million gallons per day (mgd) (655 gallons per minute), or 1,057 acre-ft/year during average water supply demand conditions (assumed at 61°F ambient temperature) and 1.8 mgd (1,260 gpm) during peak water supply demand conditions (assumed at 94°F ambient temperature with duct firing). If duct firing is implemented to the maximum amount permitted, then the yearly water consumption would be approximately 1,182 acre-feet per year. These flow rates account for losses in the water treatment process required to meet the water demand for the plant of 0.94 mgd during average conditions and 1.8 mgd at peak conditions. The data for 61ºF were used for evaluating water supply requirements and impacts because this is essentially the average temperature at the project site (see Section 8.15.1.1). Worst-case water impact scenarios are based on the data for 94ºF, with inlet air chilling and duct firing. Figure 7.1-1 is a water balance diagram for the project, and Tables 7.1-1 through 7.1-3 show project water specifications assuming 3, 5, and 7 cycles of concentration, respectively.

7.2 WATER QUALITY

The reclaimed water quality of the tertiary effluent from the South Bay Water Treatment Plant (San Jose/Santa Clara Water Pollution Control Plant) is shown on Table 7.2-1. City of Santa Clara potable water (typically well water) quality is also shown.

7.3 WATER TREATMENT

The reclaimed water is suitable for use as cooling tower makeup and as feedwater for the power cycle makeup water treatment system. No additional treatment is expected to be required for the makeup water to the cooling tower and process. Gas turbine injection will use deionized water.

7.4 WASTE WATER COLLECTION, TREATMENT, AND DISPOSAL

The expected waste water streams from the PPP site includes the following:

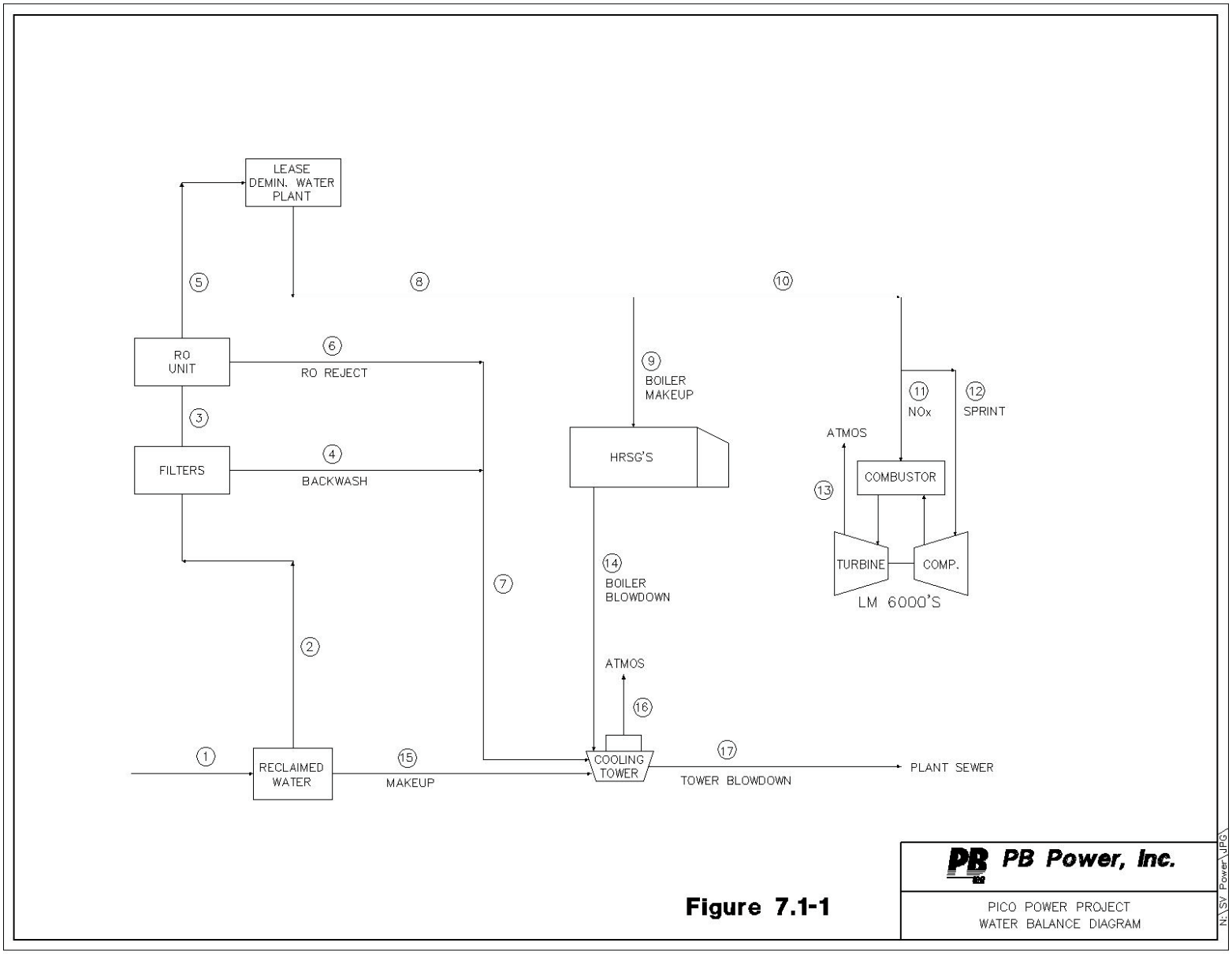
- Cooling tower and process blowdown
- Sanitary waste water
- Plant drainage

The average and peak flow rates for these waste water streams are presented in Figure 7.1-1 and Table 7.1-1 through 7.1-3. Each waste stream will be checked as part of the routine maintenance procedures to ensure that the discharge to the existing sewer meets appropriate City of Santa Clara discharge limits. A description of each of these streams, and any treatment performed prior to discharge, is given below.

7.4.1 Cooling Tower Blowdown

Circulating (or cooling) water system blowdown will consist of reclaimed water that has been concentrated between 3 and 7 cycles of concentration, and residues of the chemicals added to the circulating water. These chemicals will control scaling and biological growth in the cooling tower and corrosion of the circulating water piping and condenser tubes. Cooling water treatment will require the addition of a pH control agent (acid), a mineral scale dispersant (i.e. polyacrylate polymer), corrosion inhibitors (phosphate based), and biocide (i.e. bleach or equivalent). This waste stream will be discharged via a new, 900-foot-long pipeline to be installed in Lafayette Street and discharging to the existing 27-inch sanitary sewer main in Central Expressway. This stream will have a separate metering, sampling, and water quality monitoring point prior to entering the sewer, to assure it meets appropriate discharge limits. The volume of this relatively minor waste stream is expected to be 93 gpm under average conditions and 387 gpm under peak conditions. In order to determine the worst-case impact of operation, varying assumptions were used for flow balance determination and for cooling tower blowdown quality. Flows were determined assuming operation at 3 to 7 cycles of concentration, as greater flow rates will result at the lower cycles of concentration. The cooling tower blowdown component of the waste water stream was determined for operation at 5 cycles of concentration, to predict the expected component concentrations in the discharge.

Since high efficiency drift eliminators will be used in the cooling towers to achieve the lowest practicable drift rate (0.0005%), the amount of total dissolved solids (TDS) emitted to the atmosphere is very low. The drift quality is equivalent to the blowdown quality, therefore, the concentration of TDS in the drift is expected to be at maximum of 5,880 mg/L at a circulating water flowrate of approximately 24,000 gpm, or will be equivalent to a rate of 8.5 lb/day.


LEASE
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RO REJECT
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BOILER
MAKEUP
11
NOx
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SPRINT
3
FILTERS
4
BACKWASH
HRSG'S
ATMOS
COMBUSTOR
13
TURBINE
COMP.
LM 6000'S
14
BOILER
BLOWDOWN
7
2
ATMOS
16
1
RECLAIMED
WATER
15
MAKEUP
COOLING
TOWER
17
TOWER BLOWDOWN
PLANT SEWER
PB Power, Inc.
PICO POWER PROJECT
WATER BALANCE DIAGRAM
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Figure 7.1-1

Table 7.1-1. Water balance at 3 cycles of concentration (see Figure 7.1-1).

Fig. Point No.	Stream Description	Condition 1 CTG Base Load Unfired Annual Average (gpm)	Condition 1 CTG Base Load Unfired Summer (gpm)	Condition 2 CTG Base Load Full Fired Summer (gpm)
1	Plant total reclaimed water supply	655	914	1,260
2	Reclaimed water to demineralization system filter inlet	190	190	190
3	Filtered reclaimed water to RO system inlet	170	170	170
4	Filter system backwash to cooling tower	20	20	20
5	Leased demineralization system supply water	120	120	127
6	RO system reject to cooling tower	50	48	48
7	Combined filter/RO waste water to cooling tower	70	68	68
8	Total demineralized water to plant services	120	120	127
9	Demineralized water to HRSG makeup	11	11	17
10	Demineralized water to CTG (NO_x & Sprint)	110	110	110
11	CTG NO_x water @ base load chilled[1]	93	93	93
12	CTG sprint water @ base load chilled	17	17	17
13	DI water to atmosphere (contained in CTG exhaust)	110	110	110
14	HRSG blowdown to cooling tower	11	11	17
15	Reclaimed water supply to cooling tower	465	724	1,070
16	Cooling tower evaporation to atmosphere	364	535	770
17	Cooling tower blowdown (plant waste water to sewer)	182	268	385
			Tower Cycles of Conc = 3	
			HRSG BD Rate % 1.0	
	Domestic Water Uses	2		

[1]25 ppm NOx

Table 7.1-2. Water balance at 5 cycles of concentration (see figure 7.1-1).

Fig. Point No.	Stream Description	Condition 1 CTG Base Load Unfired Annual Average (gpm)	Condition 1 CTG Base Load Unfired Summer (gpm)	Condition 2 CTG Base Load Full Fired Summer (gpm)
1	Plant total reclaimed water supply	564	780	1,067
2	Reclaimed water to demineralization system filter inlet	190	190	190
3	Filtered reclaimed water to RO system inlet	170	170	170
4	Filter system backwash to cooling tower	20	20	20
5	Leased demineralization system supply water	120	120	127
6	RO system reject to cooling tower	50	48	48
7	Combined filter/RO waste water to cooling tower	70	68	68
8	Total demineralized water to plant services	120	120	127
9	Demineralized water to HRSG makeup	11	11	17
10	Demineralized water to CTG (NO_x & Sprint)	110	110	110
11	CTG NO_x water @ base load chilled[1]	93	93	93
12	CTG sprint water @ base load chilled	17	17	17
13	DI water to atmosphere (contained in CTG exhaust)	110	110	110
14	HRSG blowdown to cooling tower	11	11	17
15	Reclaimed water supply to cooling tower	374	590	877
16	Cooling tower evaporation to atmosphere	364	535	770
17	Cooling tower blowdown (plant waste water to sewer)	91	134	193
			Tower Cycles of Conc = 5	
			HRSG BD Rate % 1.0	
	Domestic Water Uses	2		

[1] 25ppm NO_x

Table 7.1-3. Water balance at 7 cycles of concentration (see Figure 7.1-1).

Point No.	Stream Description	Condition 1 CTG Base Load Unfired Annual Average GPM	Condition 1 CTG Base Load Unfired Summer GPM	Condition 2 CTG Base Load Full Fired Summer GPM
1	Plant total reclaimed water supply	534	735	1,003
2	Reclaimed water to demineralization system filter inlet	190	190	190
3	Filtered reclaimed water to RO system inlet	170	170	170
4	Filter system backwash to cooling tower	20	20	20
5	Leased demineralization system supply water	120	120	127
6	RO system reject to cooling tower	50	48	48
7	Combined filter/RO waste water to cooling tower	70	68	68
8	Total demineralized water to plant services	120	120	127
9	Demineralized water to HRSG makeup	11	11	17
10	Demineralized water to CTG (NO_x & Sprint)	110	110	110
11	CTG NO_x water @ base load chilled[1]	93	93	93
12	CTG sprint water @ base load chilled	17	17	17
13	DI water to atmosphere (contained in CTG exhaust)	110	110	110
14	HRSG blowdown to cooling tower	11	11	17
15	Reclaimed water supply to cooling tower	344	545	813
16	Cooling tower evaporation to atmosphere	364	535	770
17	Cooling tower blowdown (plant waste water to sewer)	61	89	128
			Tower Cycles of Conc = 7	
			HRSG BD Rate % 1.0	
	Domestic Water Uses	2		

[1]25 ppm NOx

Table 7.2-1. Summary of average water quality characteristics for potential sources of project water.

Water quality parameter	South Bay WTP tertiary effluent (primary source)	Santa Clara typical potable water (well water) supply	Drinking water standard
Turbidity	1	0.15	1-5 ntu
Color	—	<5	15 Pt-Co units
Odor Threshold	—	<1	3 units
pH	7	7.6	6.0 – 9.0 units
Total Alkalinity	184	215	no standard (mg/l)
Bicarbonate	184	—	no standard (mg/l)
Total Dissolved Solids	749	317	1,500 mg/l
BOD	4	-	no standard (mg/l)
TOC	-	-	no standard (mg/l)
Phosphate	4.7	ND	no standard (mg/l)
Total Nitrogen	9.4	3.4	no standard (mg/l)
Nitrate as NO_3	40	15	45 mg/l
Fluoride	-	0.1	2 mg/l
Chloride	208	32	500 mg/l
Hardness	245	246	200 mg/l
Arsenic	0.001	-	0.05 mg/l
Calcium	48	66	no standard (mg/l)
Magnesium	29	19	no standard (mg/l)
Manganese	-	ND	0.05 mg/l
Sodium	161	27	350 mg/l
Potassium	15	ND	no standard (mg/l)
Silica	-	16	no standard (mg/l)
Silver	<0.001	-	0.1 mg/l
Sulfate	109	40	500 mg/l
Cadmium	<0.0005	-	0.005 mg/l
Chromium	0.001	ND	0.05 mg/l
Copper	0.003	ND	1.3 mg/l
Cyanide	-	-	0.2 mg/l
Iron	-	-	0.30 mg/l
Lead*	<0.001	-	0.015 mg/l
Mercury	0.0000026	-	0.002 mg/l
Nickel	0.007	ND	0.1 mg/l
Boron	0.525	0.157	no standard (mg/l)
Selenium	-	ND	0.05 mg/l
Thallium	—	ND	0.002 mg/l
Zinc	0.0519	ND	5.0 mg/l

Table 7.2-2. Circulating water quality.

Contaminant	Units	Cooling Tower Blowdown at 5 Cycles
Alkalinity-Bicarbonate	mg/L	-
Alkalinity-Carbonate	mg/L	-
Alkalinity-P-BaCl2	mg/L	-
Alkalinity-Phenol	mg/L	-
Alkalinity-Total	mg/L	920
Aluminum	mg/L	-
Ammonia	mg/L	0
Arsenic	mg/L	0.00585
Biochemical Oxygen Demand	mg/L	-
Boron	mg/L	2.625
Bromide	mg/L	-
Cadmium	mg/L	0.0025
Chloride	mg/L	1,040
Chromium	mg/L	0.005
Copper	mg/L	0.015
Cyanide	mg/L	-
Fluoride	mg/L	-
Hardness-Calcium	mg/L	241.5
Hardness-Magnesium	mg/L	143.5
Hydrogen Sulfide	mg/L	-
Iron	mg/L	-
Lead	mg/L	0.005
Manganese	mg/L	-
Mercury	mg/L	0.000013
Nickel	mg/L	0.035
Nitrate as NO_3	mg/L	45
Nitrite as NO_3	mg/L	2
Nitrogen-Total	mg/L	11
pH	s.u.	-
Phosphate	mg/L	23
Potassium	mg/L	74.5
Selenium	mg/L	-
Silica	mg/L	-
Silver	mg/L	0.005
Sodium	mg/L	805
Sulfate	mg/L	470
Total Dissolved Solids	mg/L	3745
Total Organic Carbon	mg/L	-
Total Suspended Solids	mg/L	10
Temperature	Degrees F	73
Zinc	mg/L	0.260

7.4.2 Sanitary Waste Water

Sanitary waste water from sinks, toilets and other sanitary facilities will be collected along with process water and discharged to the existing 27-inch sanitary sewer pipeline in Central Expressway through a new 900 foot long, 18-inch diameter waste water discharge pipeline. The daily sanitary waste water discharge flow will average 2 gpm.

7.4.3 Plant Drainage

Miscellaneous general plant drainage will consist of area washdown, sample drainage, equipment leakage, and drainage from facility equipment areas. Water from these areas will be collected in systems of floor drains, sumps, and pipes within the PPP and discharged to an oil/water separator. The oil free discharge water will be sent to the existing 27-inch sanitary sewer pipeline in Central Expressway. An average flow of 1 gpm and peak flow of 50 gpm is projected. The water will have essentially the same characteristics as the reclaimed water supplied to PPP.